VALUE-ADDED PRODUCTS FROM FGD SULFITE-RICH SCRUBBER MATERIALS

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ABSTRACT

OBJECTIVES: According to the American Coal Ash Association, about 29.25 million tons of flue gas desulfurization (FGD) byproducts were produced in the USA in 2003. Out of 29.25 million tons, 17.35 million tons were sulfite-rich scrubber materials. At present, unlike its cousin FGD gypsum, the prospect for effective utilization of sulfite-rich scrubber materials is not bright. In fact, almost 16.9 million tons are leftover every year. In our pursuit to mitigate the liability of sulfite-rich FGD scrubber materials' disposal, we are attempting to develop value-added products that can commercially compete. More specifically, for this three year project, we have the following overall objectives:

1. To thoroughly characterize sulfite-rich scrubber materials, from two different power plants burning different coals, and natural byproducts for their variabilities in physical and chemical properties.
2. To evaluate the chemical stability of the scrubber products, especially under our material fabrication conditions.
3. To optimize the fabrication conditions for the development of wood substitute materials from sulfite-rich scrubber material.
4. To establish manufacturing conditions for the fabrication of load-bearing lumber material from sulfite-rich scrubber materials.
5. To evaluate the long-term stability of our products.
6. To generate technology transfer parameters so that products can move from laboratory to pilot-scale manufacturing.

The focus of the project during the first year is going to be directed toward objectives 1 and 2.

ACCOMPLISHMENTS TO DATE: The major efforts during the last two months were focused on: (1) identifying the drying behavior of the sulfite-rich scrubber materials so that fabrication parameters could be optimized, (2) elucidating the thermal characteristics of the scrubber materials by undertaking differential scanning calorimetry (DSC) measurements at $30^{o}C < T < 510^{o}C$, (3) ascertaining the structural characteristics of the as-received scrubber materials, and (4) determining the total

mercury concentration in the scrubber materials and exploring whether there is any potential of mercury re-emission during product manufacturing.

The following summarizes our experimental outcomes:

1. Gravimetric measurements suggest that water is rapidly lost at the ambient temperature from the scrubber cake for the first 24 hours, and thereafter there is a dramatic decrease in the rate of water evaporation. However, for our product manufacturing, 24 hours of scrubber cake drying will be adequate.
2. The XRD diffraction of the as-received, but air-dried, scrubber cake from Plant B indicated peaks at 11.7, 16.1, and 16.7 degrees, thus, suggesting the scrubber cake to be a mixed phase of $CaSO_3.0.5H_2O$, $CaSO_3.4H_2O$, and $(CaSO_4)_x.(CaSO_3)_{1-x}.nH_2O$.
3. Our DSC measurements indicated that the products developed from the sulfite-rich scrubber materials will be stable as long as the temperature is < 400^oC.
4. The mercury concentrations in sulfite-rich scrubber material should be determined at least after 14 days of air drying ($T < 30^oC$) time.
5. On subjecting the scrubber material to high temperatures and pressures typically expected during our product development, we did not observe any statistically significant emission of mercury from the scrubber cake.

FUTURE WORK: During the next ten months, the following research activities are planned:

- To thoroughly chemically characterize the scrubber materials including their mercury, selenium, and arsenic content. Any potential of re-emission during product manufacturing will be evaluated.
- To determine the structure of incoming scrubber cakes by XRD, FTIR, SEM, and TEM techniques. In addition, the scrubber materials' structure will be evaluated after they have been subjected to product manufacturing conditions.
- To evaluate how scrubber materials interact with natural byproducts under our product manufacturing conditions.

LIST OF PAPERS: none

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